Mirror56 tool, QE map, QE

Teaching for the PITZ shift crew

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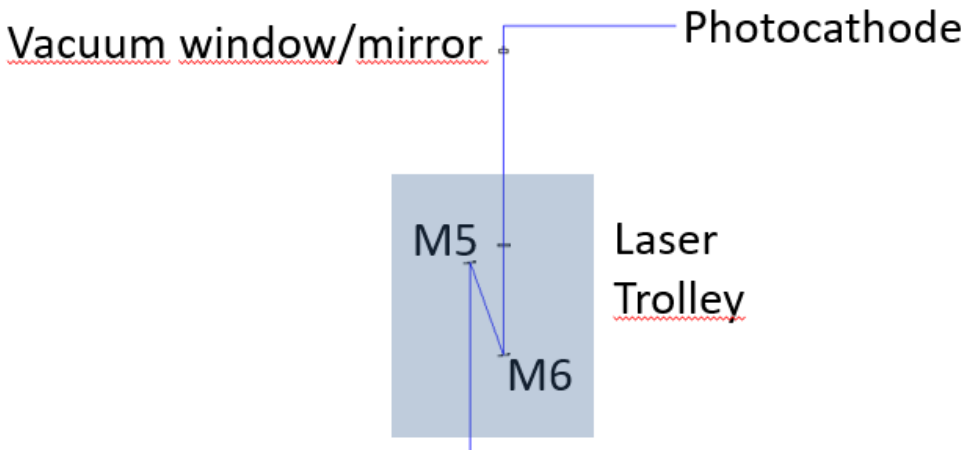
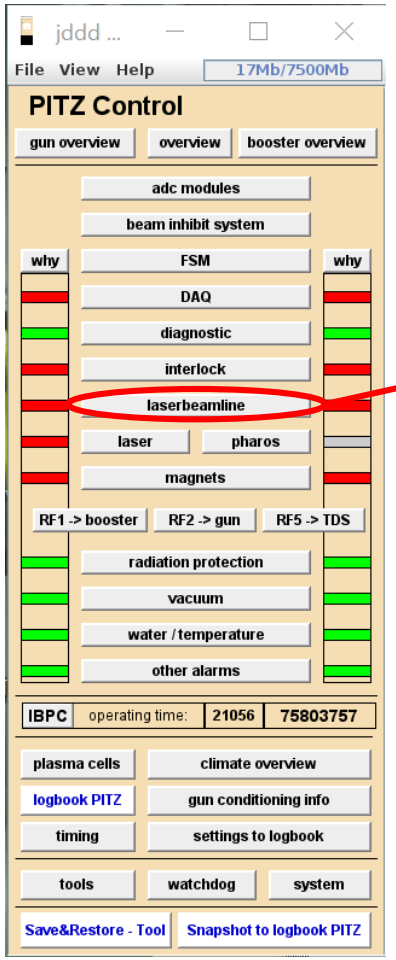
The Laser Trolley

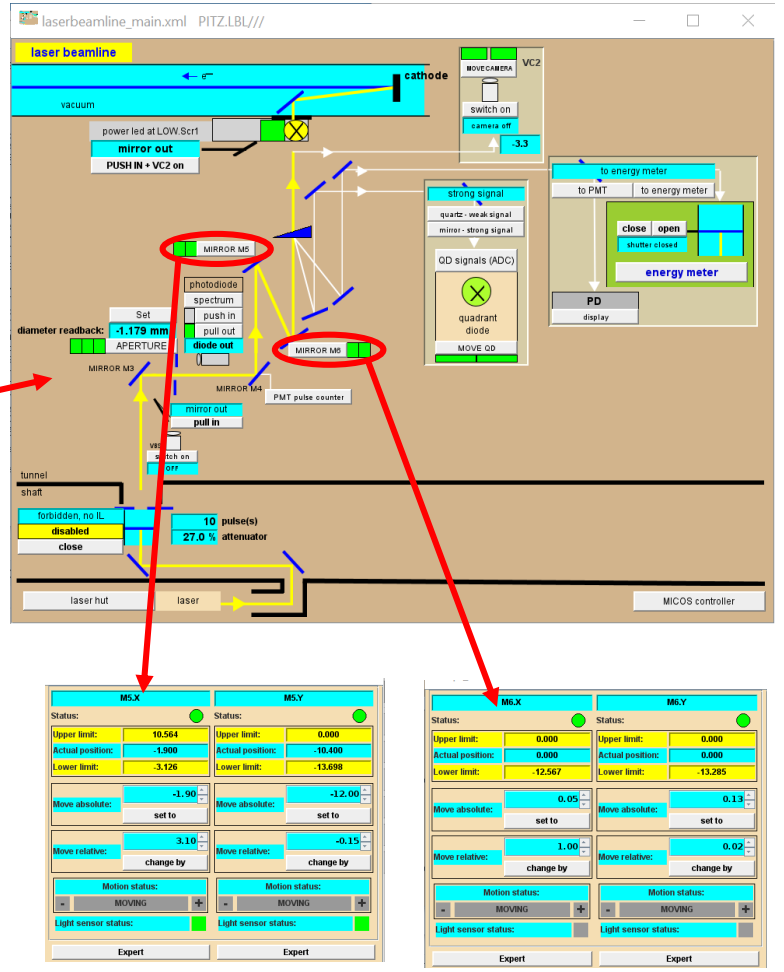
Laser beam distribution and characterization in the accelerator tunnel

- Two mirrors M5 and M6
  - 4 degrees of freedom → able to choose beam positions on vacuum mirror and photocathode independently



- Mirrors 5 and 6

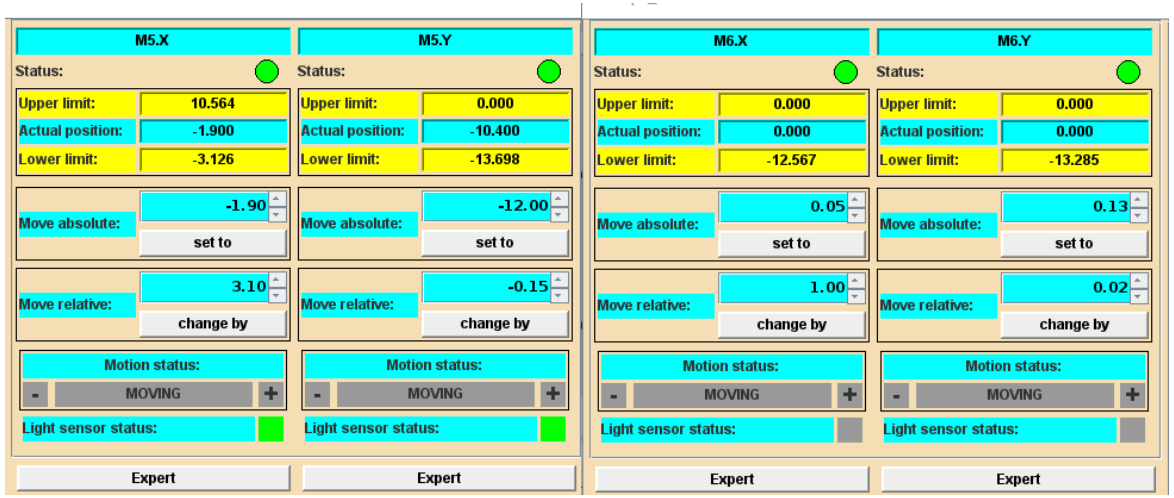




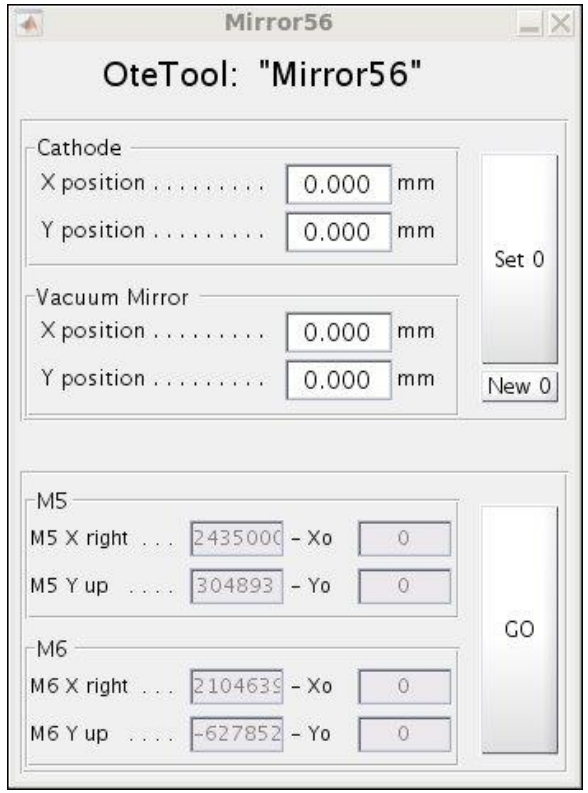
Mirror56 – Standard Matlab Script

Script does all the linear algebra calculations for positioning the laser beam

- Before using the tool: print backup of positions of mirrors 5 and 6 to logbook
  - Makes it possible to go back to starting position in case mirrors stopping during movement and losing absolute positioning



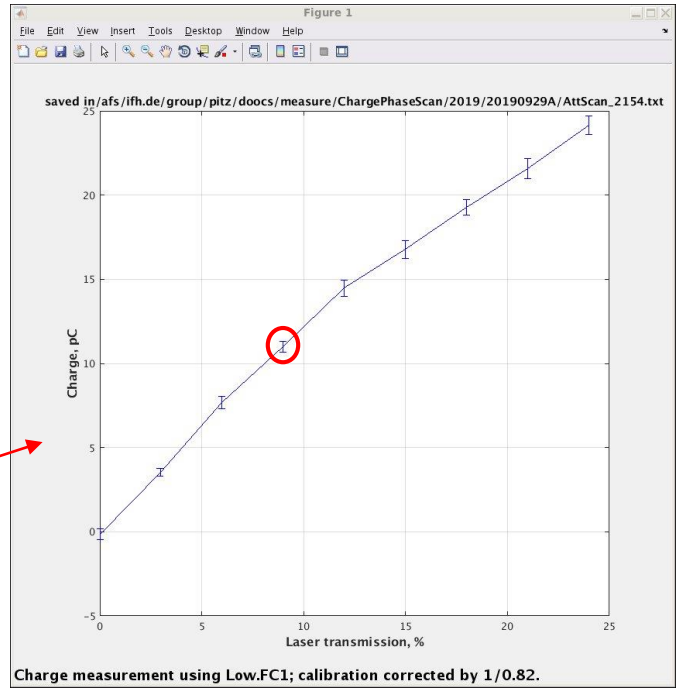
- Script Mirror56
  - Type new relative position
  - Click “GO”
  - Wait for execution – check in Matlab window
- Set 0
  - All relative positions go back to 0, but no mirror movements yet
- New 0
  - Current mirror positions are set as new relative 0 (warning window will open first)



QE Map

Preparations

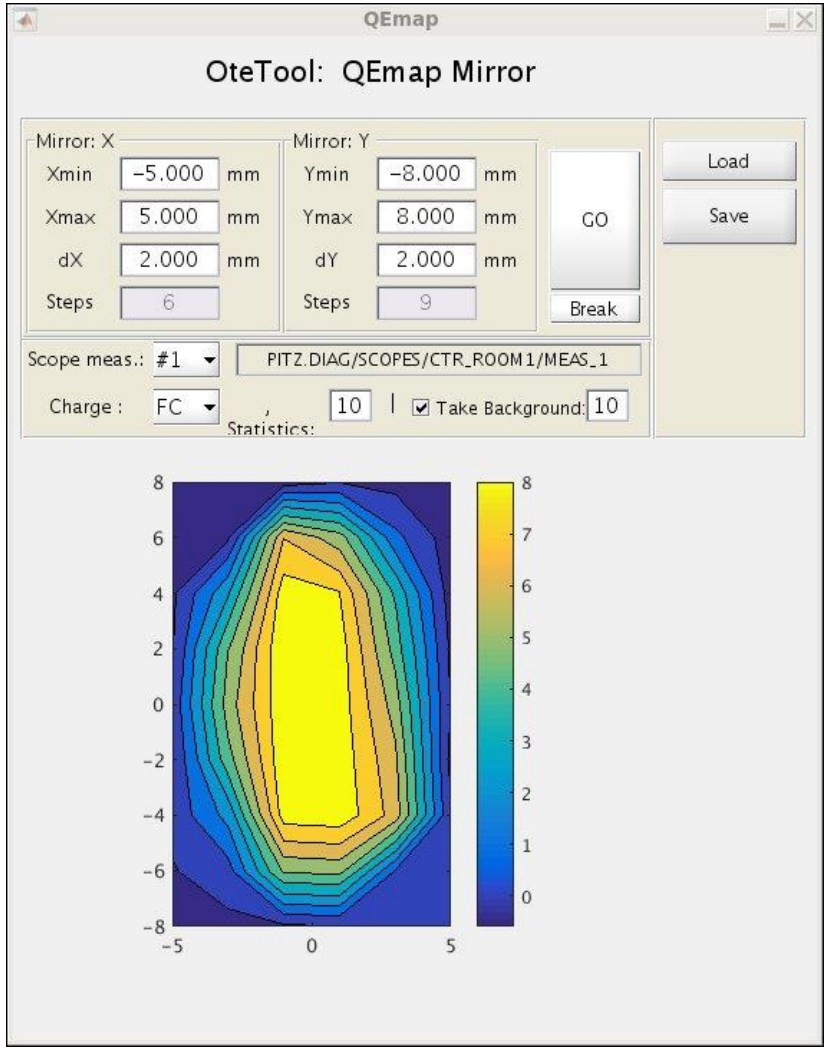
- Set gun to nominal gradient: power 6.5 MW in the gun @ MMMG phase
- Choose a BSA of 0.25mm
- Choose solenoid current, so that the beam is focused on the screen of measurement unit (Low.Scr1 for Low.FC1 or Low.Scr2 for Low.FC2), e.g. 450A for Low.Scr1
- Insert Faraday cup
- Run attenuator scan script: tools → measureQE
- Choose an attenuator setting in the linear part of the scan, at about the upper 3/4 of the linear part where the bunch charge is about 10 to 15 pC



QE Map

Measurement: vacuum mirror

- Find the movement range for the QE map (vacuum mirror):
  - Print positions of mirror5 and mirror6 to logbook
  - Run mirror56 script
  - Move beam on vacuum mirror and observe the charge from the Faraday cup → find the left, right, top, bottom edge of the vacuum mirror
  - Move beam back to 0,0 position
- Run the script QEmap
  - Choose mirror, choose scope
  - Scan range as found above
  - Choose step size: dX = 0.5 mm, dY = 1.0 mm
  - Charge measurement: Faraday cup
  - Define scope measurement channel (#1 or #2)
  - Statistics: 10
  - Take Background: 100 (check box)
- Save results and print to logbook
- Choose new middle position on vacuum mirror; go there and record in logbook

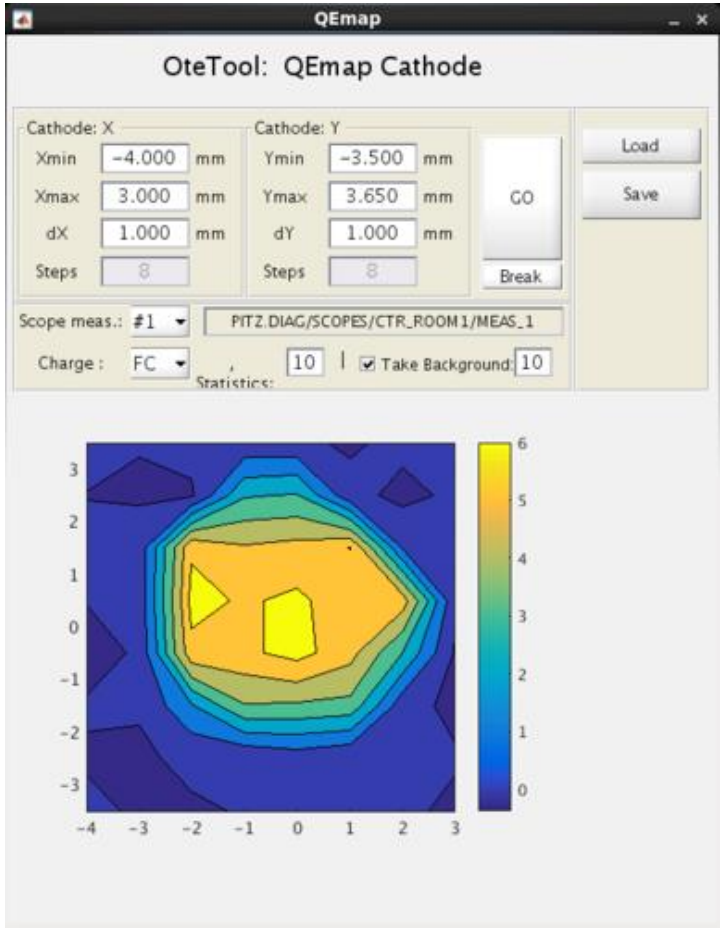


QE Map

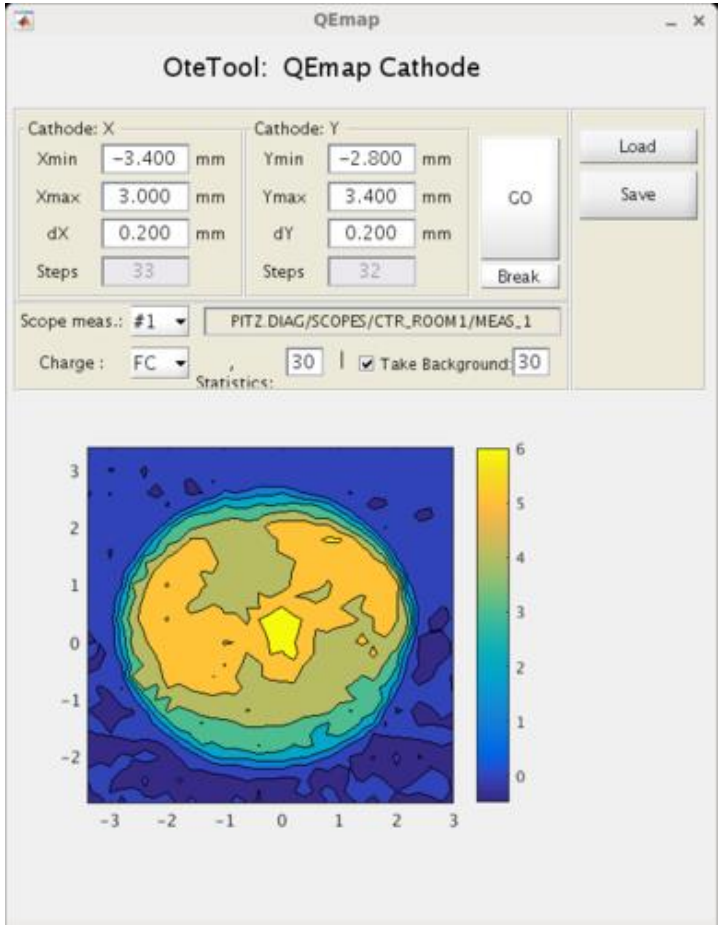
Measurement: QE map

- Find the movement range for the QE map (cathode): same as for vacuum mirror
- Run the tool QEmap and do a coarse scan
  - Choose cathode and scope
  - Scan range as found above
  - Choose step size: dX = dY = 1.0 mm
  - Charge measurement: Faraday cup
  - Statistics: 10; Take Background: 100 (check box)
- Save results and print to logbook
- If the range is well defined (cathode fully visible and fills most of the area) do a fine scan
  - dX = dY = 0.2 mm
  - Statistics: 30; Take Background: 100 (check box)
- Save results and print to logbook

Rough QE map



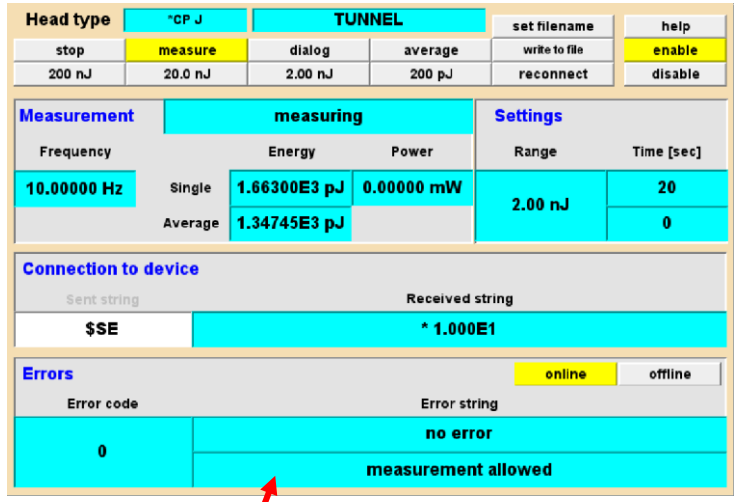
Fine QE map

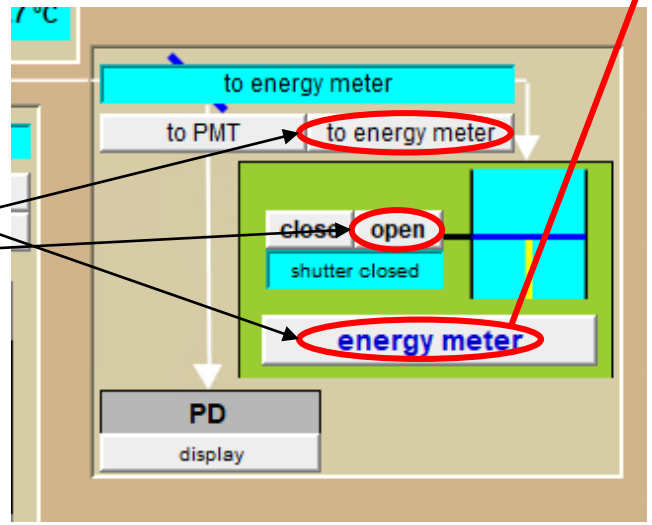


QE Measurement

Preparations

- Set laser BSA size to 1.0 mm or different, if specified
- Set gun to nominal gradient: power 6.5 MW in the gun @ MMMG phase
- Measure momentum after gun with LEDA
- Put the gun phase to MMMG
- Choose solenoid current, so that the beam is focused on the screen of measurement unit (Low.Scr1 for Low.FC1 or Low.Scr2 for Low.FC2), e.g. 450A for Low.Scr1
- Insert Faraday cup
- Check that laser beam is on energy meter
  - Start energy meter GUI from laserbeamline GUI
  - Click ‚measure‘
  - Open energy meter shutter; click , to energy meter‘
  - Open shutter
  - If necessary, adjust energy range
- → Frequency 10 Hz, Energy >0 and updating



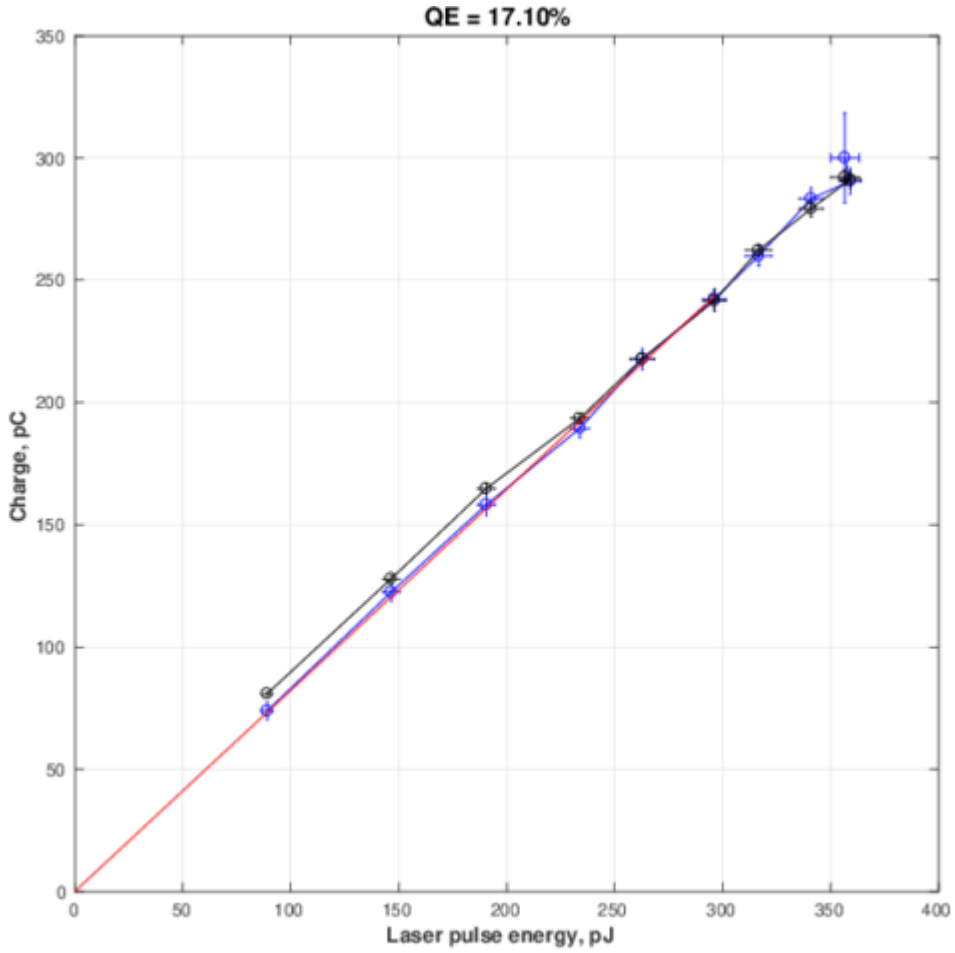


QE Measurement

Measurement

- Run MeasureQE script: tools → measureQE
- Print measurement output window to PITZ logbook
- Write to logbook entry
  - BSA size:
  - Gun SP and power:
  - Phase SP: x (MMMG +/- z)
  - Solenoid-Current:
  - Laser pulse shape/-length:

- **Wrap up**
- Remove Faraday Cup (FC) from beam tube
- Close energy meter shutter
- Option: close laser shutter, adjust number of pulses and LT



Data saved to